

Application No. 09/904,704

REMARKS

The above-identified patent application has been reviewed in light of the Examiner's Action dated November 17, 2004. Claims 1, 7, 10, 16, 20 and 21 have been amended, without intending to abandon or to dedicate to the public any patentable subject matter. No claims have been canceled. Accordingly, Claims 1-21 are now pending. As set out more fully below, reconsideration and withdrawal of the rejections of the claims are respectfully requested.

Initially, Applicants would like to thank the Examiner for the courtesies extended during the telephone interview that was held between the Examiner and the undersigned on February 14, 2005. During that interview, the disclosures of the cited references in relation to the claimed invention were discussed. More particularly, the undersigned emphasized that simultaneous operations in connection with components associated with devices for storing data as set forth in certain of the claims were not disclosed by the cited references. Furthermore, the undersigned proposed amendments to the claims to emphasize such distinctions, which amendments are set forth in the present Amendment and Response. In addition, the undersigned noted that other aspects of the invention set forth in the claims were not found in the cited references, such as the particular limitations regarding a RAID controller incorporating a multiplexer, as set forth in Claims 19-21. No agreement regarding allowable subject matter was reached during the telephone interview.

The claimed invention is generally directed to improved RAID 1 write performance in low cost systems. In particular, embodiments of the claimed invention are capable of writing a primary copy of data and a mirror copy of data on a pair of devices comprising a RAID 1 array substantially simultaneously. As set forth in greater detail elsewhere herein, the references cited in the Office Action do not teach, suggest or disclose each and every element of the claims. Therefore, reconsideration and withdrawal of the rejections of the claims are respectfully requested.

Claims 1, 2, and 6-8 stand rejected under 35 U.S.C. §102 as being unpatentable over U.S. Patent No. 6,389,493 to Barkley et al. ("Barkley"), and Claims 16-21 stand rejected under 35 U.S.C. §102 as being unpatentable over U.S. Patent No. 6,801,954 to Rust et al. ("Rust"). In order for a rejection under 35 U.S.C. §102 to be proper, each and every element as set forth in a claim must be found, either expressly or inherently described, in a single prior art reference. (MPEP §2131.)

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However, each and every element of Claims 1, 2, 6-8 and 16-21 cannot be found in the cited references. Accordingly, reconsideration and withdrawal of the rejections of Claims 1, 2, 6-8 and 16-21 as anticipated are respectfully requested.

Claim 1 is generally directed to a method for controlling data transfer between a host and a plurality of storage devices. According to the method, first data addressed to a transport master is received at the transport master. In addition, the first data for storage addressed to the transport master is received at a transport slave. Furthermore, the first data for storage is received at the transport master and the transport slave substantially simultaneously. Amended Claim 1 additionally recites that the transport master provides the first data to a first storage device for storage at substantially the same time that the transport slave provides the first data for storage to a second storage device. Support for the amendments to Claim 1 can be found in the original specification, for example at page 4, lines 9-10. Claim 1 further recites storing the first data on a first storage device and storing the first data on a second storage device.

The Barkley reference is generally directed to a system and method for dynamically allocating bandwidth to a plurality of slave cards coupled to a bus. More particularly, Barkley discusses a bus management system in which a master card coupled to the bus controls the amount of bus bandwidth that is allocated to slave cards also interconnected to the bus. (Barkley, Abstract.) According to Barkley, rather than providing a fixed distribution of bus bandwidth to the slave cards, the master card is capable of dynamically allocating bandwidth to the slave cards in order to accommodate the changing needs of the slave cards. (Barkley, col. 1, ll. 36-39.) However, there is no description in Barkley of providing first data addressed to a transport master to the transport master and to a transport slave at substantially the same time, or providing the first data to a first storage device interface from the transport master and to a second storage device interface from the transport slave at substantially the same time. Furthermore, the portion of Barkley cited for disclosing receiving data addressed to the transport master at the transport master and at the transport slave substantially simultaneously (Barkley, col. 1, ll. 55-67 and col. 2, ll. 1-3) discusses communications between a communication module of the master card and slave cards over the bus, according to the allocated bandwidth. There is no disclosure in Barkley of operations by a transport

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master and a transport slave that are performed substantially simultaneously with respect to first data. Accordingly, each and every element of Claim 1 and dependent Claims 2 and 6-8 are not expressly, or inherently described by Barkley, and the rejections of these claims should be reconsidered and the rejections withdrawn.

Applicants further note that pending dependent claims recite additional patentable subject matter. For example, Claim 2 recites "receiving a request for one of said first data and second data at said transport master, wherein said request for data is addressed to said transport master." In addition, Claim 2 recites "receiving said request for one of said first data and second data at said transport slave, wherein said request for data is addressed to said transport master." Claim 2 further recites:

retrieving said requested one of said first data and second data from said first storage device and from said second storage device, wherein in a normal operating mode said requested one of said first data and second data from said first storage device is provided by said transport master to said host and said requested one of said first data and second data from said second storage device is not provided to said host.

Applicants submit that there is no disclosure in Barkley of an arrangement according to which a request for data is received at a transport master and a transport slave substantially simultaneously, retrieving the requested data from first and second storage devices, and in a normal operating mode providing the requested data from the transport master, while not providing the requested data from the transport slave. For example, the portion of Barkley cited in the Office Action in connection with the retrieval of data as recited by Claim 2 (Barkley, col. 2, ll. 4-16) states that a slave card can communicate with a master card over a bus according to a dynamically allocated bandwidth and that a communication module associated with the slave card sends and receives data on the bus according to the allocated bandwidth. The cited portion of Barkley further recites that a control module associated with the slave card can request that the master card change the allocated bandwidth. However, there is no description of retrieving the same requested data from two different storage devices, or of providing that data to the host from a transport master but not from a transport slave.

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Therefore, for at least these additional reasons, Barkley does not disclose each and every element of Claim 2, and the rejection of Claim 2 should be reconsidered and withdrawn. Claim 6 specifies that, in a non-RAID operating mode, "said first data for storage and said second data for storage addressed to said transport master received at said transport slave is not stored on said second storage device." There is no disclosure in Barkley of a choice of modes according to which data may be provided from a transport master and a transport slave to respective storage device interfaces substantially simultaneously, and in which data received at both the transport master and the transport slave substantially simultaneously is passed to a storage device interface associated with the transport master, but is not passed to a storage device interface by the transport slave in a non-RAID operating mode. Furthermore, the portion of Barkley cited in the Office Action with respect to Claim 6 (Barkley, col. 4, ll. 46-57) discusses the provision of queues and memory, but is not related to alternate operating modes. Accordingly, for at least these additional reasons, Claim 6 is not anticipated by Barkley, and the rejection of Claim 6 should be reconsidered and withdrawn.

Independent Claim 16, rejected as anticipated by Rust, is generally directed to a RAID controller. Amended Claim 16 recites a transport master interconnected to a system bus interface, a first device interface interconnected to the transport master, and a first storage device directly interconnected to the first device interface. The RAID controller of amended Claim 16 also includes a transport slave interconnected to the system bus interface, a second device interface interconnected to the transport slave, and a second storage device directly interconnected to the second device interface. Support for the amendments to Claim 16 can be found in the specification, for example in Fig. 2. Furthermore, Claim 16 recites that "at least one of a command and data addressed to said transport master and received at said system bus interface is passed to said transport master and is passed to said transport slave substantially simultaneously."

The Rust reference is generally directed to a method and apparatus to concurrently operate on multiple data movement transactions in a disk array subsystem. More particularly, Rust discusses a disk array controller that has two identical controller boards to enhance reliability by providing continuous backup and redundancy in the event that one controller becomes inoperable. (Rust, col. 4, ll. 21-26.) The controllers 54a and 54b are each interconnected to a disk array 50 with multiple

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storage disks 52. (Rust, col. 4, ll. 8-10 and 20-23; Fig. 2.) However, there is no description in Rust of a first storage device directly interconnected to a first device interface of a controller or a second storage device directly interconnected to a second device interface of the controller as recited in Claim 16. Accordingly, for at least these reasons, Claim 16 and dependent Claims 17-21 are not anticipated by Rust, and the rejections of these claims should be reconsidered and withdrawn.

In addition, Applicants note that at least some of the claims that depend from Claim 16 are additional patentable subject matter. For example, Claim 19 additionally recites "a multiplexer comprising a first input interconnected to said first device interface, a second input interconnected to said second device interface, and an output interconnected to said transport master." In connection with Claim 19, the Office Action cites to Rust's discussion of a multiplexer 604, provided as part of a PCI initiator 502. (Rust, col. 8, ll. 66-67; Fig. 6.) The multiplexer 604 is interconnected to a number of data buses 522, 526 and 528 that are in turn interconnected to targets comprising a memory interface 510, an FPCI interface 514, and a com interface 516. (Rust, Fig. 5; col. 6, ll. 57-65.) The targets 510-516 are in turn interconnected to a common transaction bus 518. (Rust, Fig. 5; col. 6, ll. 60-65.) Accordingly, the multiplexer of Rust does not include a first input interconnected to a first device interface (where the first device interface is directly interconnected to a first storage device) a second input interconnected to a second device interface (where the second device interface is directly interconnected to a second storage device) and an output interconnected to a transport master. Furthermore, the PCI initiator 502 of Rust is not directly interconnected to any storage device and is integral to a transaction manager 82, which is itself a component of a controller 54, therefore it is unclear how Rust could anticipate Claim 19. Accordingly, for at least these additional reasons, Claim 19 (and Claims 20 and 21, which depend from Claim 19) are not anticipated by Rust, and the rejections of these claims should be reconsidered and withdrawn.

Claims 3-5 and 9-14 stand rejected under 35 U.S.C. §103 as being unpatentable over Barkley in view of Rust. In order to establish a prima facie case of obviousness under §103, there must be some suggestion or motivation to modify the reference or to combine the reference teachings, there must be a reasonable expectation of success, and the prior art reference or references must teach or

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suggest all the claim limitations. (MPEP §2143.) Because each and every element of the invention as claimed cannot be found in the cited references, as set forth more fully below, the rejections under 35 U.S.C. §103 should be reconsidered and withdrawn.

Claims 3-5 generally depend from Claim 1. As noted more fully above, the Barkley reference does not teach, suggest or disclose each and every element of Claim 1. Furthermore, the Rust reference does not supply the elements missing from Barkley. More particularly, whether considered alone or in combination, neither of the cited references teach, suggest or describe receiving first data addressed to a transport master at the transport master and the transport slave substantially simultaneously, and providing from the transport master and from the transport slave that data to respective interfaces substantially simultaneously. Accordingly, for at least these reasons, the rejections of Claims 3-5 as obvious should be reconsidered and withdrawn.

In addition, Claim 4 recites "passing a write confirmation signal from said first storage device interfaced to said transport master, and passing a write confirmation signal from said second storage device interface to said transport slave." The Office Action finds that these elements are described in Rust, at column 7, lines 20-28. However, it is noted that this portion of Rust describes receiving transactions from an external bus and placing the transaction into a write buffer until the target is ready. That portion of Rust further discusses buffering data supplied to the initiator from a target in a read buffer until an external element reads that data from the read buffer. There is no disclosure in Rust of passing a write confirmation signal from a first storage device to a transport master and passing a write confirmation signal from a second storage device to a transport slave as recited by Claim 4, therefore withdrawal of this rejection is respectfully requested.

Claim 5 also depends from Claim 1 and recites "passing a write confirmation signal from said first storage device interfaced to said transport master, passing a write failure signal from said second storage device interface to said transport slave, providing said write failure signal to said transport master, and notifying said host of said write failure signal." The Office Action cites to Rust, column 7, lines 20-40 with respect to the element of passing a write failure signal from said second device interface to said transport slave. However, there appears to be no mention of such a signal in the cited portion of the Rust patent. Similarly, the Office Action cites to Rust at column 7, lines 45-56,

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for the elements of "providing said write failure signal to said transport master," and notifying said host of said write failure signal." However, that portion of Rust is directed to describing the integration of a processor 506 that can read data from memory and perform operations on the data and then write that data back to memory or to any device in the system via targets, as part of a manager 82. There appears to be no description of providing a write failure signal originating from a second storage device to a transport master and notifying the host of the write failure signal. Accordingly, reconsideration and withdrawal of the rejection of Claim 5 for these additional reasons are respectfully requested.

Claim 10 is generally directed to a method for storing and retrieving data in a RAID 1 system. Claim 10 further recites providing data for storage that is addressed to a transport master to a transport slave at substantially the same time the data is provided to the transport master. In addition, Claim 10 recites storing said data in a first storage device and a second storage device substantially simultaneously.

Whether considered alone or in combination, the cited references do not teach, suggest or describe each and every element of Claim 10. For example, there is no disclosure in either reference of providing data for storage to a transport slave at substantially the same time that the data for storage is provided to a transport master. Furthermore, there is no teaching, suggestion or disclosure of storing the data in first and second storage devices substantially simultaneously. More particularly, the Rust reference, which is cited in the Office Action for disclosing concurrent transaction processing modules, does not disclose storing data in first and second storage devices substantially simultaneously. Instead, the concurrent transaction processing modules of Rust are parallel disk array controllers 54 to provide backup and redundancy should one controller become inoperable (Rust, col. 4, ll. 21-26). Storing data in storage devices substantially simultaneously is not discussed by Rust. Accordingly, for at least these reasons, each and every element of Claim 10 is not found in the cited references, and the rejections of Claim 10 and dependent Claims 11-15 should be reconsidered and withdrawn.

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The application now appearing to be in form for allowance, early notification of same is respectfully requested. The Examiner is invited to contact the undersigned by telephone if doing so, in any way, would expedite the resolution of this case.

Respectfully submitted,

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